PB-215 331

REPORT FOR CONSULTATION ON THE COMMONWEALTH OF PUERTO RICO AIR QUALITY CONTROL REGION

National Air Pollution Control Administration
Washington, D. C.

May 1970

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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE

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Details of illustrations in this document may be better studied on microfiche

U. S. DEPARTMENT OF HEALTH EDUCATION AND WELFARE
PUBLIC HEALTH SERVICE
National Air Pollution Control Administration

May 1970

I

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SECTION I

THE REGIONAL APPROACH TO AIR QUALITY CONTROL AND A FEDERAL PROPOSAL FOR THE COMMONWEALTH OF PUERTO RICO

REPORT FOR CONSULTATION ON THE PUERTO RICO AIR QUALITY CONTROL REGION

Preface

The Secretary, Department of Health, Education, and Welfare is directed by the Clean Air Act, as amended, to designate air quality control regions prior to the adoption by the State (territory) of air quality standards and plans for the implementation of the standards. The establishment of air quality control regions has to this point been the result of Federally initiated action, specifying areas where regions should be designated, and formally proposing for Consultation with State and local authorities, boundaries for those regions.

The State (territory) may upon their own initiative, recommend to the National Air Pollution Control Administration boundaries for air quality control regions. The Department of Health of the Commonwealth of Puerto Rico has initiated a proposal for region boundaries under that policy.

The boundary proposal is based upon a consideration of technical and non-technical factor related to the air pollution problem in an urban area. The recommendation for region boundaries should also consider all the relevant engineering and urban factors.

The Region boundaries proposed in the report reflect consideration of available and pertinent data; however the boundaries remain subject to revision suggested by consultation between Federal and State (territory) authorities. Formal designation will be witheld pending the outcome of the meeting. This report is intended to serve as the starting point for the consultation.

INTRODUCTION

Air pollution, because of its direct relationship to people and their activities, is an urban problem. Urban sprawls often cover thousands of square miles; they quite often include parts of more than one state and almost always are made up of several municipalities. Air pollution, therefore, also becomes a regional problem, and the collaboration of several local governmental jurisdictions is prerequisite to the solution of the problem in any given area. Air quality control regions are meant to define the geographical extent of air pollution problems in different urban areas and the combination of jurisdictions that must contribute to the solution in each.

The regional approach set up by the Clean Air Act is illustrated in Figure 1. The approach involves a series of steps to be taken by Federal, State, and local governments, beginning with the designation of regions, the publication of air quality criteria, and the publication of information on available control techniques by the Federal Government. Following the completion of these three steps, the Governors of the States affected by a region must file with the Secretary within 90 days a letter of intent, indicating that the States will adopt within 180 days ambient air quality standards for the pollutants covered by the published criteria and control technology documents and adopt within an additional 180 days plans for the implementation, maintenance, and enforcement of those standards in the designated air quality control regions.

The Federal legislation provides for a regional attack on air pollution and, at the same time, allows latitude in the form which regional efforts may take. While the Secretary reserves approval authority, the States involved in a designated region assume the responsibility for developing standards and an implementation plan which includes administrative procedures for abatement and control.

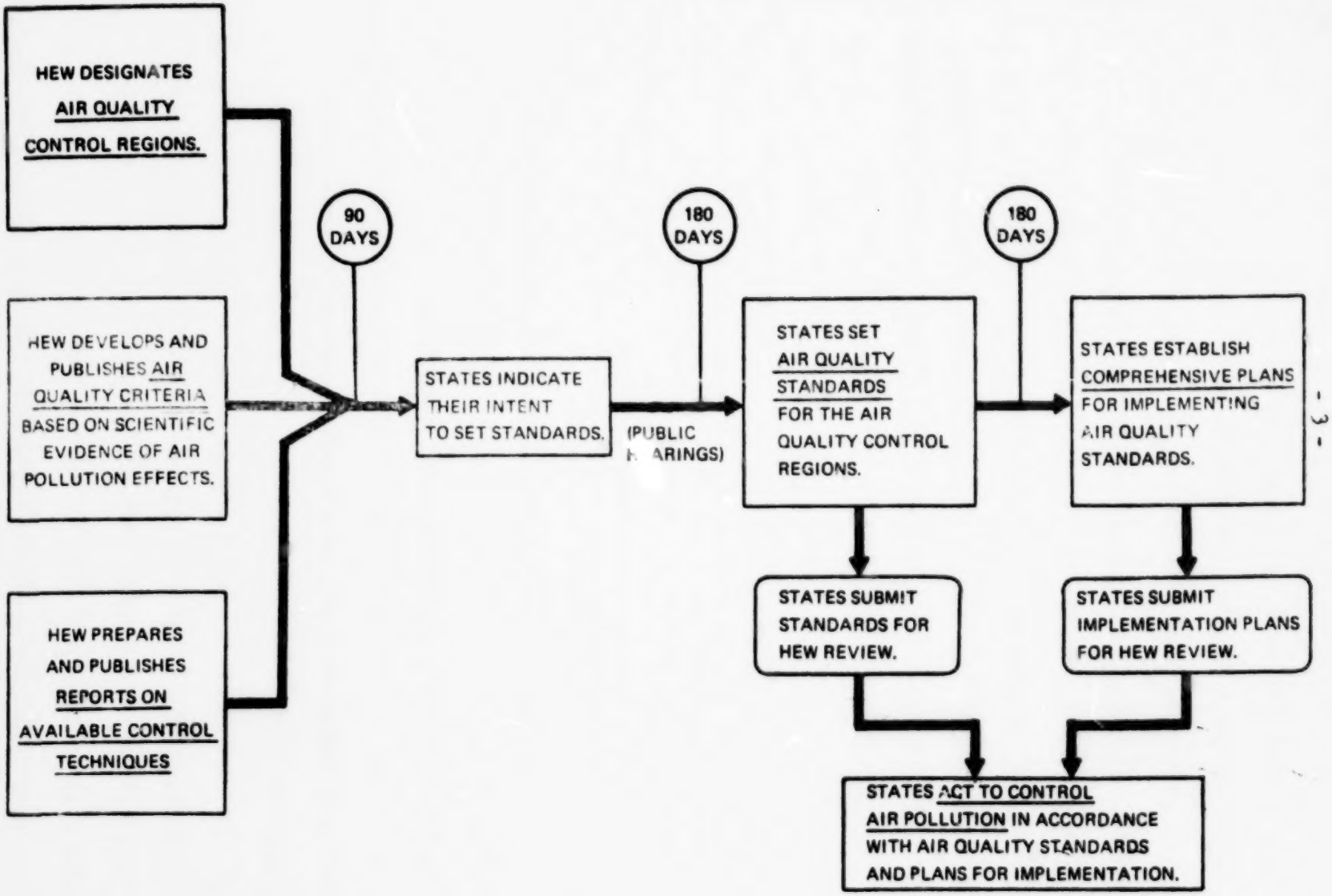
HEW DESIGNATES AIR QUALITY CONTROL REGIONS.
HEW DEVELOPS AND PUBLISHES AIR QUALITY CRITERIA BASED ON SCIENTIFIC EVIDENCE OF AIR POLLUTION EFFECTS.
HEW PREPARES AND PUBLISHES REPORTS ON AVAILABLE CONTROL TECHNIQUES
90 DAYS
STATES INDICATE THEIR INTENT TO SET STANDARDS.
180 DAYS
(PUBLIC HEARINGS)
STATES SET AIR QUALITY STANDARDS FOR THE AIR QUALITY CONTROL REGIONS.
180 DAYS
STATES ESTABLISH COMPREHENSIVE PLANS FOR IMPLEMENTING AIR QUALITY STANDARDS.
STATES SUBMIT STANDARDS FOR HEW REVIEW.
STATES SUBMIT IMPLEMENTATION PLANS FOR HEW REVIEW.
STATES ACT TO CONTROL AIR POLLUTION IN ACCORDANCE WITH AIR QUALITY STANDARDS AND PLANS FOR IMPLEMENTATION.

Figure 1 FLOW DIAGRAM FOR ACTION TO CONTROL AIR POLLUTION ON A REGIONAL BASIS, UNDER THE AIR QUALITY ACT.

The basic objectives in the designation of an air quality control region is that it be self-contained, i.e. that the transfer of air pollution out of or into a region is minimized. This objective recognizes the fact that an air quality control region cannot be delineated in a way to make it completely independent with respect to the air pollution problem. Because air pollutants can be carried long distances, the air over a region can be subjected occasionally or even frequently to trace amounts of pollution from other cities and individual sources located outside its boundaries. Under specific and episodic conditions such contributions can even reach significant quantities. The problem of a boundary designation is further compounded in that urban areas generally do not end abruptly but are surrounded by activities that can contribute to the pollution of the urban area as well as be the recipients of its generated pollution. Consideration of all these possibilities would result in regions substantially larger than is practical or even necessary to get to the brunt of the problem. The primary question, therefore, becomes one of relative magnitude and frequency.

The boundaries of regions, however, should encompass areas that contain sources that add significantly to the pollution load of the air as well as the areas that are significantly and continously affected by it. For this purpose, the delineation of regional boundaries is based on evaluation of annual and seasonal air pollutant emissions and resultant ambient concentrations rather than those based on short-term and specific conditions.

The selection of regional boundaries should not be based solely on today's conditions and needs but, perhaps more importantly, should give consideration to future development and growth of the area. For this purpose, extensive consideration should be given to prescribed metropolitan plans as well as the forecasted growth. Such considerations should result in the designation of regions that will contain the sources and receptors of regional air pollution for a number of years to come. This is not to say

that the regional boundaries should remain stationary and unchanged. Periodic review of boundaries is desirable, and changes in the boundary should be considered if conditions warrant.

The delineation of region boundaries solely on the basis of source locations and distributional patterns of ambient air pollution would most likely result in regions that do not follow any existing governmental boundaries, are difficult to define, and, more importantly, extremely difficult it not impossible to administrate. It is for this purpose that existing juristictional entities are reviewed and wherein practical the boundary lines of a region should include that combination of whole jurisdictions that encompasses the problem area. There can be exceptions to this philosophy, however. The presence of overly large jurisdictions, marked topographical features (mountains), or notable differences in development within a given jurisdiction may, in some cases, make it desirable to include only portions of some jurisdictions.

A region, then, will represent a balance between the various objectives discussed so far to the extent that any two of them lead to different conclusions. The strengh of some factors over others may lead to region boundaries which exclude some sources of pollution that might affect the air quality of part or all of the nearby region under certain conditions. Even though the impact of such sources would probably be minimal, the implementation plan required under the Clean Air Act for the region should provide a mechanism for the control of point sources that are located just beyond the region boundary. Such a provision would be consistent with the basic objective of provinding desirable air quality within an area being designated as an air quality control region.

Information on current industrial, commercial, and residential land use, transportation system, and population density is of direct value in that it illustrates generally the location of industry and people in an urban area. Furthermore, it is through

an evaluation of estimated patterns of urbanization that the air quality control region can be designed to provide for future growth and expansion of the urban area.

Figure 2 summarizes the the procedure used by the National Air Pollution Control Administration for designating air quality control regions.

A preliminary delineation of the region is developed by bringing together two essentially separate studies--the "Evaluation of Engineering Factors," and the "Evaluation of Urban Factors."

The study of "Engineering Factors" indicates the location of pollution sources and the geographic extent of serious pollutant concentrations in the ambient air. Pollution sources are located by an inventory of emissions from automobiles, industrial activities, space heating, waste disposal, and other pollution generators. Pollution concentrations in the ambient air are estimated from air quality sampling data and from a theoretical diffusion model. When it exists, air quality sampling data is more reliable than the theoretical diffusion model results since the data is directly recorded by pollution measuring instruments. Unfortunately, in many cases extensive air quality sampling data is available for only one or two pollutants.

The study of "Urban Factors" encompasses all non-engineering considerations. It reviews existing governmental jurisdictions, current air pollution control programs, present concentrations of population and industry, and expected patterns of urban growth. Other non-engineering factors are discussed when they are relevant. As a whole, the study of urban factors indicates how large an air quality control region must be in order to encompass expected growth of pollution sources in the future. It also considers which group of governmental jurisdictions will most effectively administer a strong regional air quality control program.

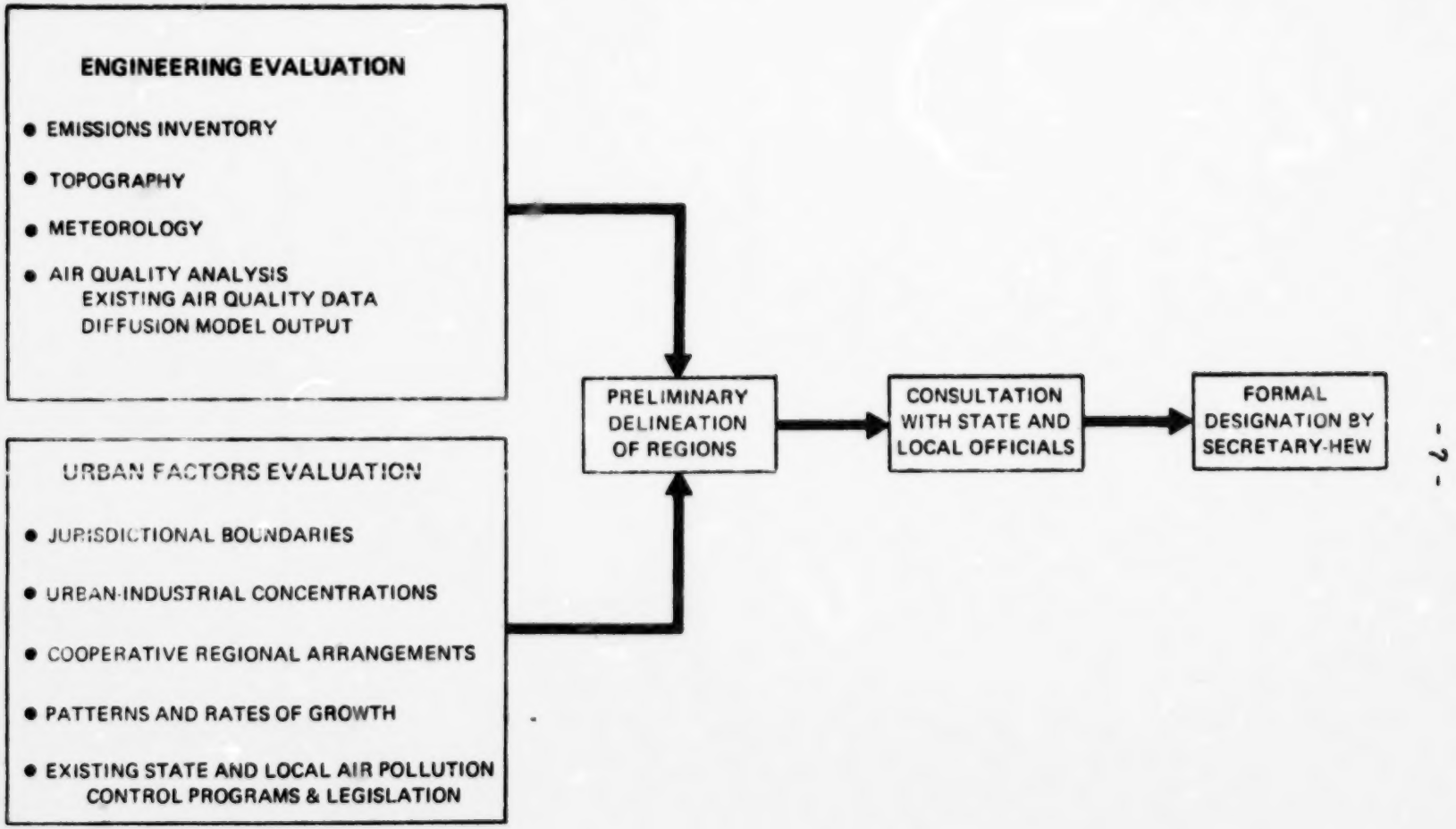
ENGINEERING EVALUATION
• EMISSIONS INVENTORY
• TOPOGRAPHY
• METEOROLOGY
• AIR QUALITY ANALYSIS
EXISTING AIR QUALITY DATA
DIFFUSION MODEL OUTPUT
URBAN FACTORS EVALUATION
• JURISDICTIONAL BOUNDARIES
• URBAN-INDUSTRIAL CONCENTRATIONS
• COOPERATIVE REGIONAL ARRANGEMENTS
• PATTERNS AND RATES OF GROWTH
• EXISTING STATE AND LOCAL AIR POLLUTION CONTROL PROGRAMS & LEGISLATION
PRELIMINARY DELINEATION OF REGIONS
CONSULTATION WITH STATE AND LOCAL OFFICIALS
FORMAL DESIGNATION BY SECRETARY-HEW

Figure 2. FLOW DIAGRAM FOR THE DESIGNATION OF AIR QUALITY CONTROL REGIONS.

The conclusions of the engineering study are combined with the results of the urban factors study to form the basis of an initial proposal for an air quality control region. As shown in Figure 2, the proposal is then submitted for consultation with State and local officials. After reviewing the suggestions raised during the consultation, the Secretary formally designates the region with a notice in the Federal Register and notifies the governors of the State affected by the designation.

The body of this report contains a proposal for the boundaries of the Commonwealth of Puerto Rico Air Quality Control Region and supporting studies on engineering and urban factors. The report itself is intended to serve as the background document for the formal consultation with appropriate State and local authorities.

THE FEDERAL PROPOSAL

The National Air Pollution Control Administration has reviewed the proposal and supportive discussion prepared by the Department of Health of the Commonwealth of Puerto Rico. NAPCA concurs with the findings of the Department and proposes an air quality control region consisting of the entire Commonwealth of Puerto Rico consisting of the following jurisdictions of the Commonwealth: Puerto Rico and surrounding islands; Vieques and surrounding islands; and Culebras and surrounding islands.

The three objectives outlined earlier as factors considered for the size of a region are met by the proposed delineation. Since the entire jurisdictional area of Puerto Rico is proposed, all of the sources and receptors would be located in one region. It follows that all of the population, both at present and in the future would also be located within the proposed region.

The third objective, that the region boundaries be compatible with unified and cooperative governmental administration, can be best met by including the Commonwealth of Puerto Rico in its entirety. Air pollution control activities for the island of Puerto Rico and all of its overseas territories are officially conducted under the preventive functions authorized by the Commonwealth to the Puerto Rico Department of Health.

The proposed Region is considered to be one which will be capable of maintaining and, hopefully, improving the air quality of the Commonwealth of Puerto Rico.

SECTION II

ANALYSIS AND PROPOSAL FOR THE COMMONWEALTH OF PUERTO RICO

AIR QUALITY CONTROL REGION

COMMONWEALTH OF PUERTO RICO
Department of Health
Environmental Health Service
Air Pollution Control Program
San Juan, Puerto Rico
May 1970

Description of the Region

The commonwealth of Puerto Rico is an Island located (centered) at latitude 18°15' and longitude 66°30', approximately 1,600 miles southeast from New York and 1,059 miles east southeast from Miami, Florida. With a territorial extension of 3,434 square miles the Island is the most easterly and smaller of the Major Antilles. The territorial jurisdiction of the Commonwealth of Puerto Rico includes three (3) other islands, i.e., Vieques (17 sq. miles), Mona (15 sq. miles), Culebras (11 sq. miles) and some small barren islands.

Puerto Rico is a hilly, tropical Island. The soil of the coastal plains are fertile and there are many lush valleys, but there are dry areas in the South which need irrigation. The climate is mild with a mean temperature of 76°F. A central mountain range extends from East to West with the highest elevation at Cerro Puntas (1338) meters).

ENGINEERING FACTORS EVALUATION

The engineering evaluation for the Commonwealth of Puerto Rico area was based primarily on a study of topography, air pollutants emissions, meteorology and air quality levels. The air pollutant emissions data used was based on an emission inventory conducted in 1966. An updated emission inventory of the San Juan Metropolitan Area was conducted by the National Air Pollution Control Administration and is summarized in this report.

Air quality levels were based on data produced by the five (5) air sampling stations (permanent) established in the Island by the National Air Surveillance Network (NAPCA) and operated by the Department of Health.

Emission Inventory - Puerto Rico Department of Health

The emission inventory performed by the Air Pollution Control Program 1966 and the one under realization was based on estimates rather than measured emissions. Approximately 2,400 air pollution potential sources were personally interviewed and an inventory questionnaire was filled.

The emission estimate was calculated for five air pollutants, i.e., oxides of sulfur, oxides of nitrogen, hydrocarbons, carbon monoxide, and particulate matter. Sulfur oxides, total particulates and carbon monoxide are considered to indicate the general geographic extent of the overall air pollution problem. Sulfur oxides and nitrogen oxides emissions illustrate to a fair degree the contribution of fuel

burning activities for stationary sources to the overall problem. Carbon monoxide emissions provide a good indication of the contribution of gasoline powered motor vehicles on the regional air pollution pattern. Particulate matter emissions represent the extent of refuse disposal, or incinerations, sugar cane field burning, and the impact of metallurgical and mineral products industries.

Table 1 shows the results of the emission inventory. To make a better representation of the overall problem the emission estimates are calculated by towns and then added to form cores of emission areas which naturally correspond to urban concentrations. Some major pollution sources are established outside the core areas and will be identified accordingly.

Emission sources are grouped in six general categories which represent the bulk of the emitters. These categories are industrial emissions, transportation, electrical power production, sugar mills, and refuse disposal. The industrial emissions are further subdivided into the emissions from fuel combustion and the manufacturing processes.

Transportation emissions include the release of pollutants into the atmosphere from motor vehicles, aircraft, and ships while at harbor. Sugar mills emissions include the estimated discharge of contaminants, from fuel combustion (mostly bagasse) and the burning of sugar cane field contributes in a great degree to the emission estimate levels attributed to the sugar mills category.

AIR POLLUTION ESTIMATE EMISSIONS FROM SELECTED SOURCES IN PUERTO RICO 1965-66

(tons/day)

Region	Industries: Fuel Combustion	Industries: Processes and Operation	Transportation[2]	Power Plants	Sugar Mills[3]	Open-burning (Disposal)
North	10.4	78.8	226.8	-	2262.6	157.6
South	215.5	21.7	403.2	128.8	673.8	930.3
East	5.1	2.2	252.0	-	339.4	292.5
West	3.0	4.3	226.8	1.3	452.5	162.7
Northeast	138.6	49.9	1411.2	188.9	37.7	77.2
Tons/day		529.5	2520.0	319.0	3771.0	1,620.3
Tons/year		148,166	919,800	116,435	592,047	591,300

(1) Does Not include emissions from Union Carbide, Caribe Nitrogen and Puerto Rico Chemical Co.

(2) Includes Motor Vehicles and vessels on ports (information obtained from Public Works Dept. Vehicles Registration Report and the Statical Report of Ports Authority - 1966)

(3) Includes sugar cane field burning

TABLE I

Refuse disposal emissions include only the air pollution from the 71 open burning dumps operated throughout the Island. Incinerators are being used more and more to dispose of household refuse, but they have not been included in the inventory yet due to their small contribution to the problem.

Emission Inventory - National Air Pollution Control Administration

The National Air Pollution Control Administration conducted an emission inventory within the Metropolitan San Juan Area. Based upon 1969 data, the San Juan survey included nine municipalities shown in Figure A. A complete report of this study will be issued by NAPCA in early summer, 1970. The results of two important aspects of this study -- emission densities and emissions by various source categories -- are summarized in the following portion of this report.

A grid coordinate system, shown in Figure A, was used to define the geographical distribution of air pollutant emissions. The grid coordinate system used was the Universal Transverse Mercator (UTM) System. Grid squares are 5 or 10 kilometers on a side, depending on the intensity of urban development in an area. The estimated emissions of each of the three pollutants (by grid zone) were expressed as average daily emissions in tons/sq. mile on an annual basis. Annual average emission densities were calculated by dividing the total quantity of pollutants emitted in each of the grid zones by the total land area of the zone.

SAN JUAN, PUERTO RICO, METROPOLITAN AREA

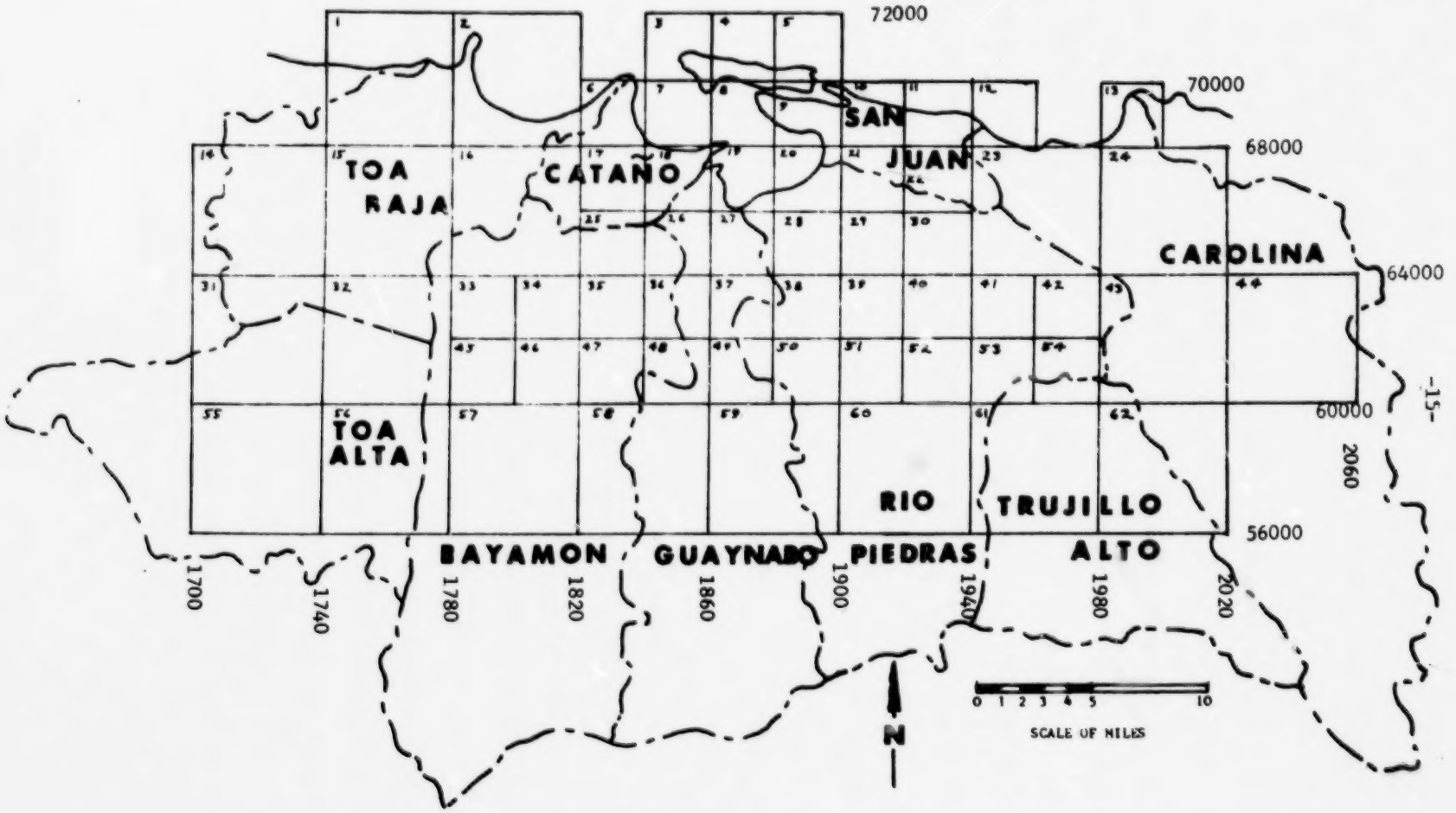

FIGURE A. GRID COORDINATE SYSTEM

Figure B shows the mean daily emission density of sulfur oxides by study area grid zone. Highest densities are found in industrial areas surrounding San Juan Bay and in the northern portion of Guaynabo, averaging over one ton per square mile daily. Grid 27 has over one-half the total sulfur oxide emissions in the entire San Juan Metropolitan Area, with the major contributions by a large point source located in the grid. Relatively high emission densities are found throughout the remainder of Catano, San Juan, and northern Rio Piedras municipalities.

Figure C shows the mean daily emission density of particulates by study area grid zone. The highest densities are found in Grids 6 and 8, with point sources the major contributors. Relatively high densities were found in San Juan, northern Guaynabo and Bayamon, and in eastern Carolina municipalities.

Figure D shows the mean daily emission density of carbon monoxide densities are highest in the more densely populated portions of the region. Over 85% of the carbon monoxide emissions were from transportation sources and this aspect can be observed by the higher emission densities along the major traffic arteries out of San Juan -- Route 1 to the south, Route 2 to the West, and Routes 3 and 26 to the east.

Table 1-A summarizes the air pollutant emissions in the 9-municipality study area. About 98% of all sulfur oxide emissions are the result of fuel combustion, with over 82% of total area sulfur oxide emissions the result of fuel combustion in steam-electric power plants. Particulate emissions are relatively low in the area, with transportation sources

SAN JUAN, PUERTO RICO, METROPOLITAN AREA

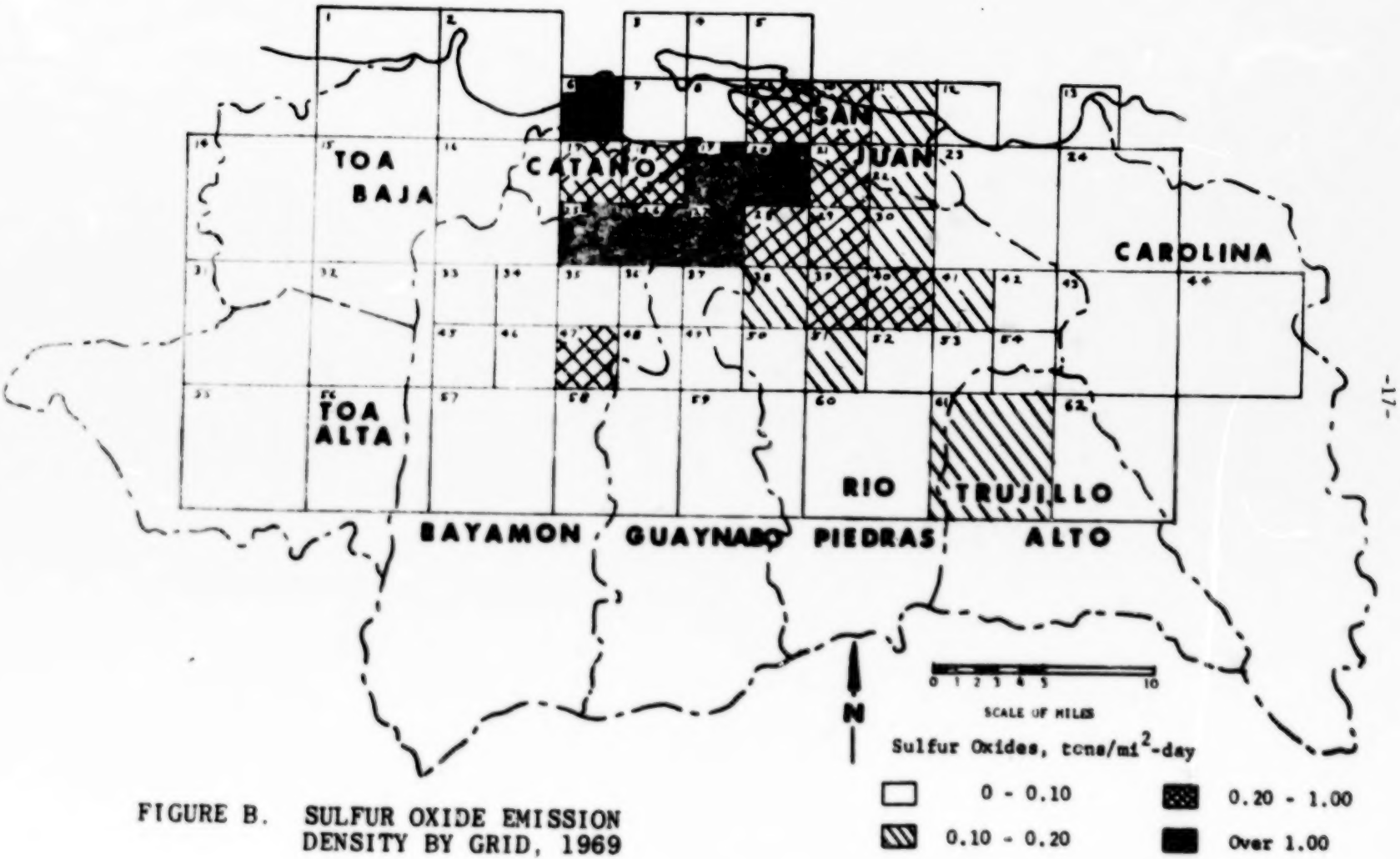

FIGURE B. SULFUR OXIDE EMISSION DENSITY BY GRID, 1969

SAN JUAN, PUERTO RICO, METROPOLITAN AREA

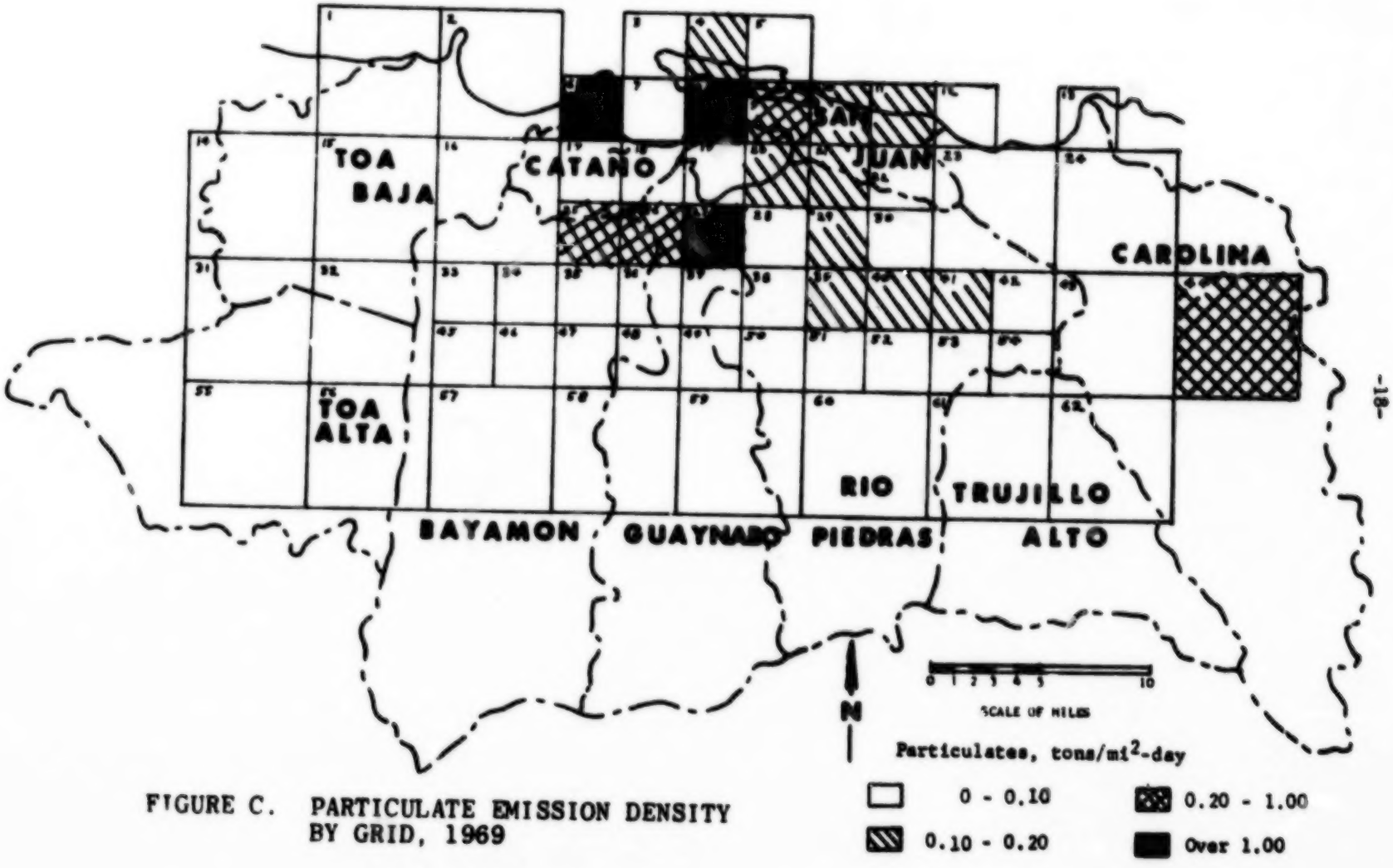

FIGURE C. PARTICULATE EMISSION DENSITY BY GRID, 1969

SAN JUAN, PUERTO RICO, METROPOLITAN AREA

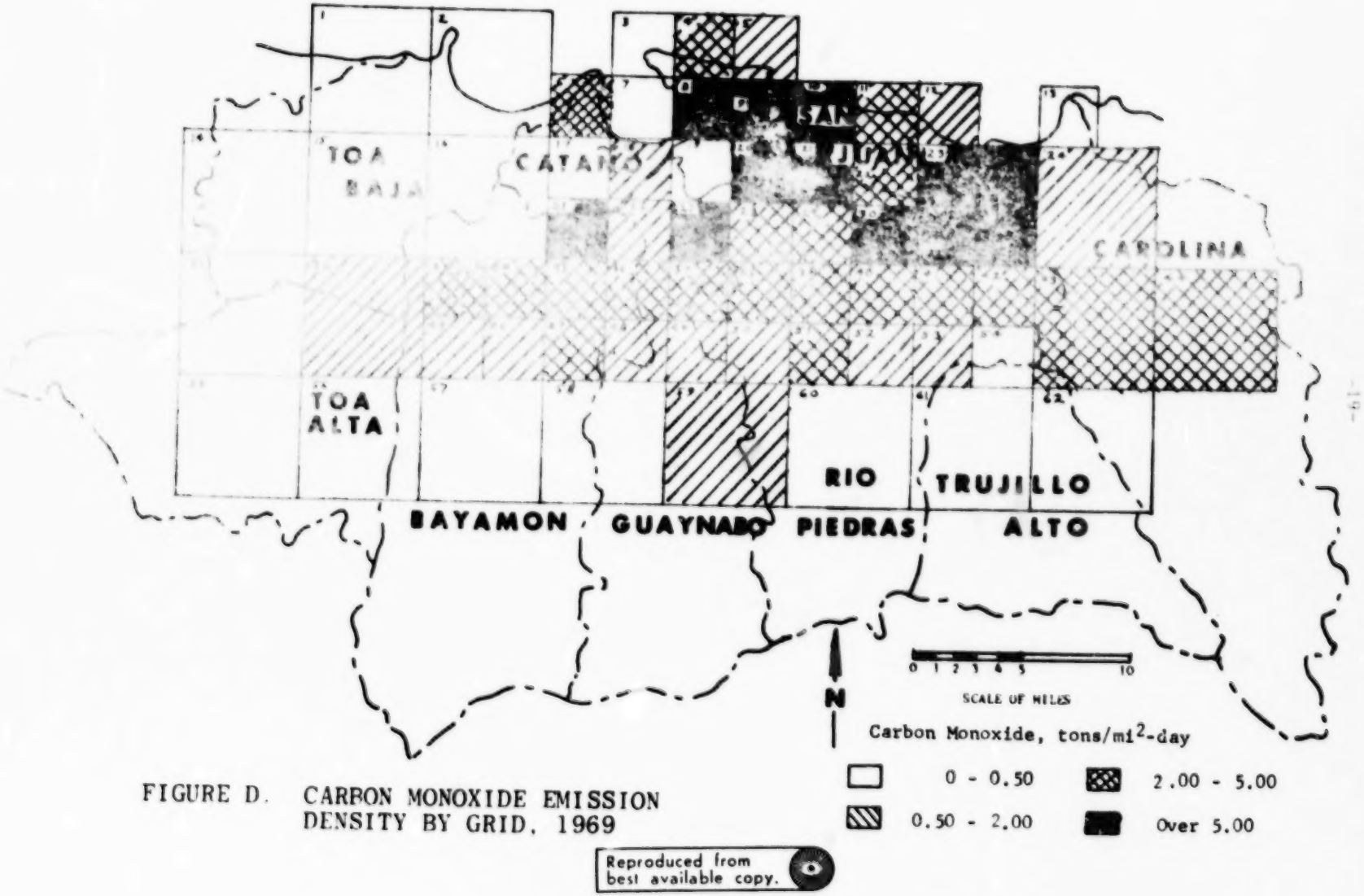

FIGURE D. CARBON MONOXIDE EMISSION DENSITY BY GRID, 1969

Reproduced from best available copy.

SUMMARY OF AIR POLLUTANT EMISSIONS IN METROPOLITAN SAN JUAN, PUERTO RICO (TONS/YEAR)

TABLE 1-A

SOURCE CATEGORY	SULFUR OXIDES	PARTIC-ULATES	CARBON MONOXIDE
TRANSPORTATION			
Road Vehicles	502	899	83,792
Other	1,966	2,041	3,6276
Sub-Total	2,468	2,941	120,068
COMBUSTION OF FUELS			
Industry	11,814	722	63
Steam-Electric Plants	73,428	1,877	37
Residential	0	0	0
Commercial & Institutional	1,000	124	12
Sub-Total	86,243	2,724	113
REFUSE DISPOSAL			
Incineration	0	0	0
Open Burning	98	1,577	8,381
Sub-Total	98	1,577	8,381
INDUSTRIAL PROCESS	183	395	13,681
GRAND TOTAL	88,994	7,639	142,244

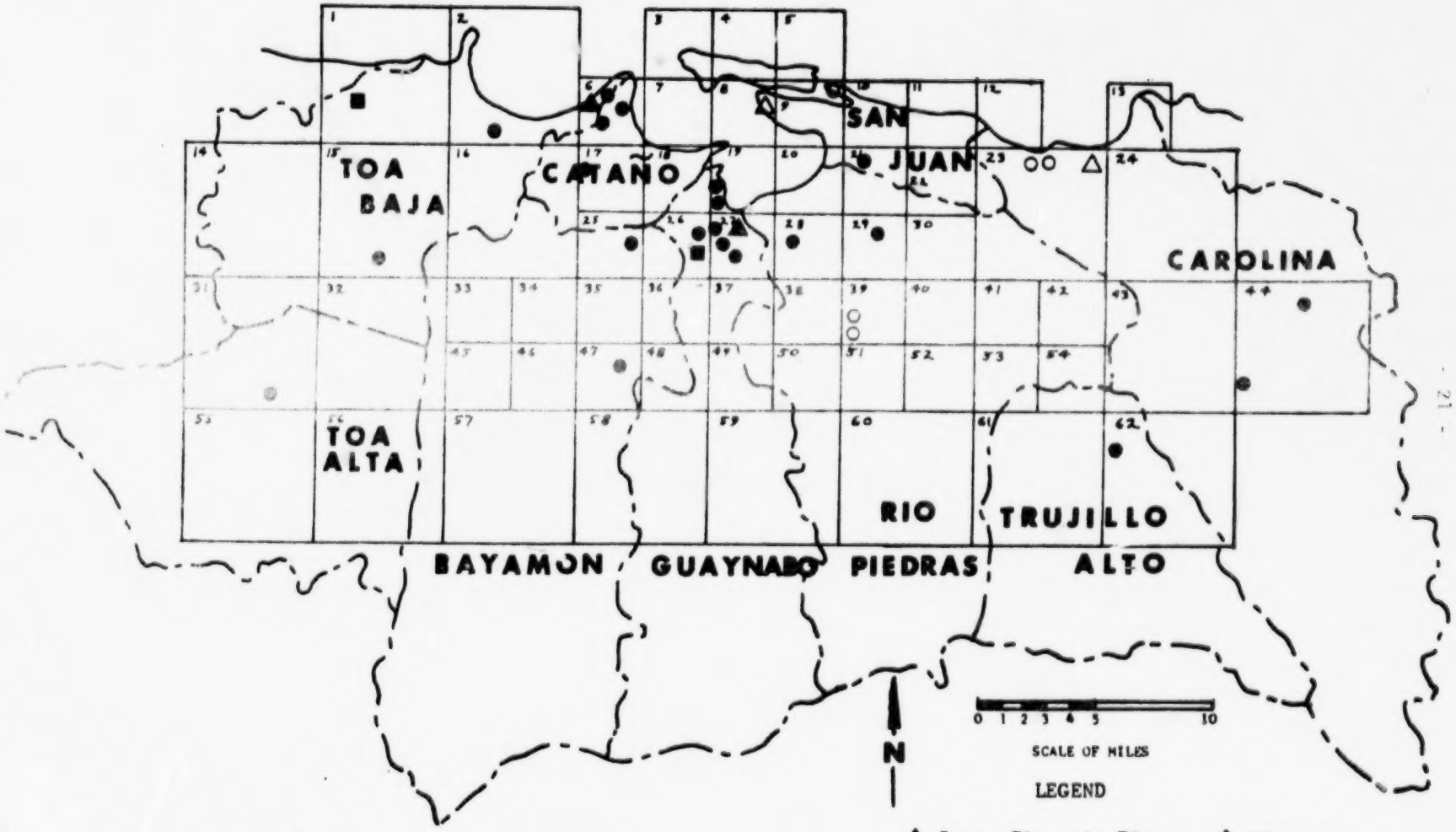

FIGURE E. LOCATION OF MAJOR POINT SOURCES.

contributing 38%, fuel combustion 36%, and refuse disposal 21%. As mentioned earlier, carbon monoxide emissions are primarily from transportation sources. The only other significant contribution to carbon monoxide emissions are industrial process losses.

Meteorology

The island of Puerto Rico is located in the eastern Caribbean; the region of the trade winds. This wind pattern is one of the most steady and persistent on the earth. The wind blows from easterly directions most of the time, and air motions from the west are rare. The prevailing wind direction over the Island is east-north-east. The wind is almost constantly from the ocean during daylight hours. Usually after sunset the wind shifts to the south or southeast, off the land. Radiational cooling frequently causes land wind at night, consequently, somewhat lower nighttime temperatures occur than would normally be experienced with sea breezes. This daily variation in the circulation pattern of surface winds is a contributing factor to the delightful climate of the Island.

Figure 3 shows average wind roses for San Juan for the period 1955-60. Roses shows typical winter month (February), typical summer month (August) and on annual summation. (Figures 4 and 5).

Puerto Rico is in the tropical hurricane region where the season for these storms begins June 1 and ends November 30. Several hurricanes affect this area every season, but weather records shows that only six of these storms have caused winds of hurricane intensity in the Island during the past 60 years.

WIND ROSE FOR SAN JUAN International Airport
Showing Speed and Direction Frequency for 1955-60

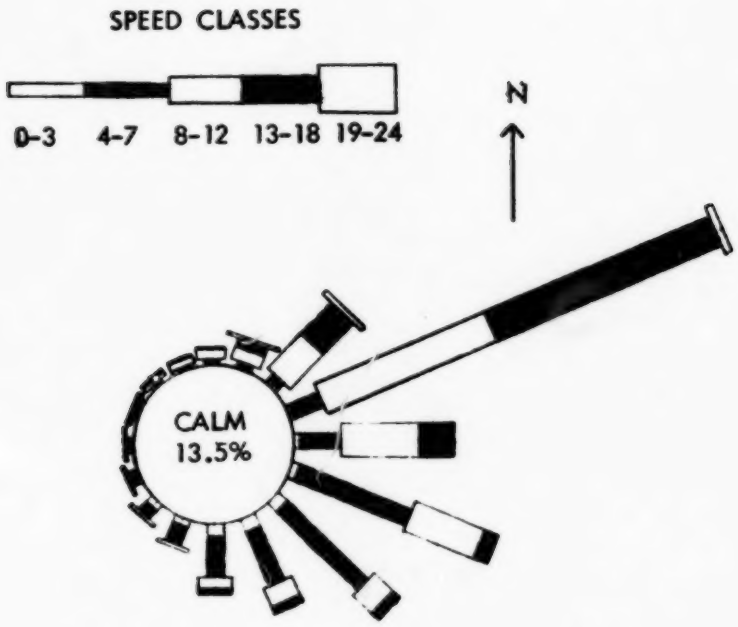

FIGURE 3

WIND ROSE - SAN JUAN International Airport
Direction Frequency Distribution 1955-60

TYPICAL WINTER MONTH

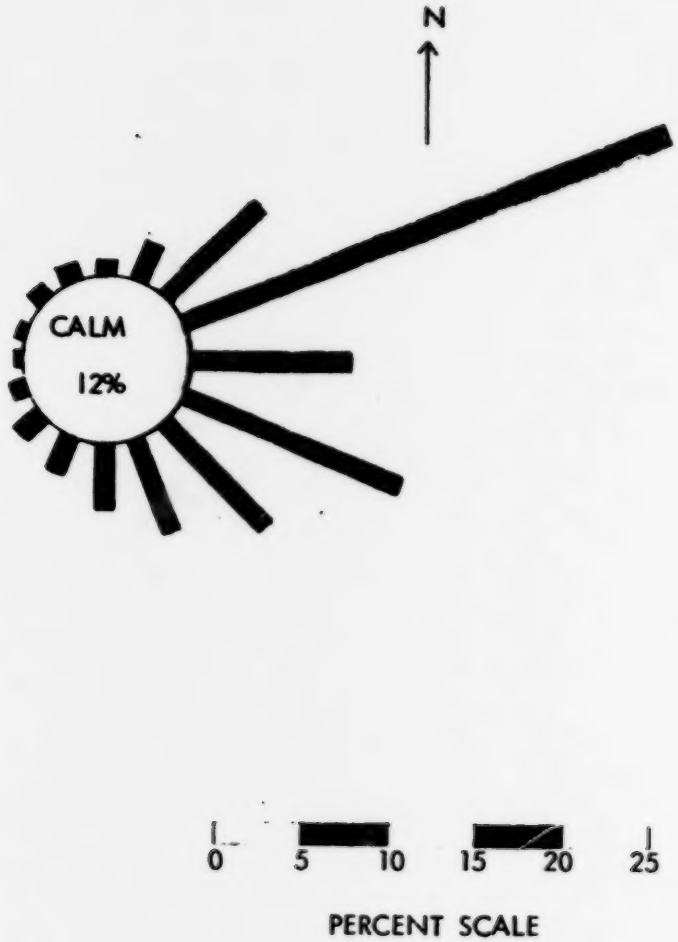

FIGURE 4

WIND ROSE - SAN JUAN International Airport
Direction Frequency Distribution 1955-60

TYPICAL SUMMER MONTH

FIGURE 5

The thermal stratification in the low levels over Puerto Rico is usually characterized as "conditionally unstable." An inversion is frequently observed near 6,000 feet, which is characteristic phenomena of the trade winds regime.

In the surface layer, below the inversion, the air has a rather large moisture content. The air above the inversion is dry. The inversion provides an upper lid to convection.

Nighttime radiation inversions at the surface are frequently observed in winter; they are less frequent in summer. A typical temperature profile at San Juan in winter shows a pronounced ground inversion extending to an altitude of about 400 feet. Such an inversion would normally disappear late morning or in the afternoon.

URBAN FACTORS EVALUATION

Present population and population growth patterns are important in the overall air pollution problem, since human activity is the ultimate cause of air pollution and humans are the ultimate victims.

Industry is the most definite sample of human activity, thus its inclusion in this report is of prime importance. Existing governmental structures must also receive consideration since the Clean Air Act, as amended, specifically notes that regions must be based on jurisdictional boundaries. Only a combination of several jurisdictions or part thereof can provide a genuine regional approach to the overall problem. The following discussion of urban factors will present these considerations as they apply to the Commonwealth of Puerto Rico.

Population

The population of the Commonwealth of Puerto Rico as of November, 1969 was 2,796,900 persons. The distribution of this population throughout the Island and its territories is illustrated in Figure 6.

The figure above represents a population annual increase of 1.3% over the previous year. The influx of immigrants to the Island was the most important factor contributing to that increment. In 1967 and 1968 the immigration was an adverse factor due to the exodus of natives to the United States. Also, in these two years the lowest population expansion was registered since 1960, due to the decreasing birth rate. This decrease is the result of a vast program of family planning developed primarily at the large urban centers.

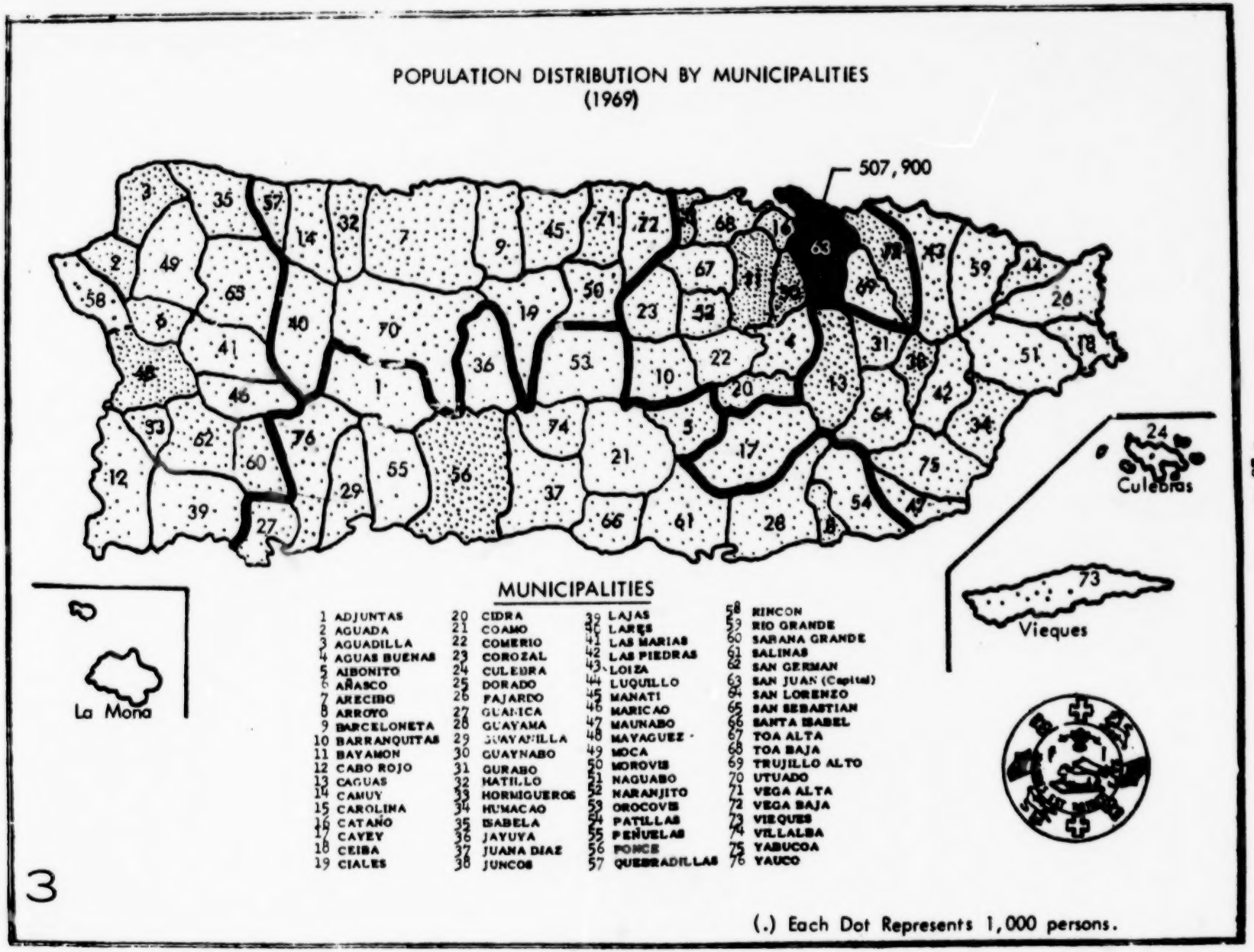
POPULATION DISTRIBUTION BY MUNICIPALITIES
(1969)
507,900
MUNICIPALITIES
1 ADJUNTAS
2 AGUADA
3 AGUADILLA
4 AGUAS BUENAS
5 AIBONITO
6 AÑASCO
7 ARECIBO
8 ARROYO
9 BARCELONETA
10 BARRANQUITAS
11 BAYAMON
12 CABO ROJO
13 CAGUAS
14 CAMUY
15 CAROLINA
16 CATAÑO
17 CAYEY
18 CEIBA
19 CIALES
20 CIDRA
21 COAMO
22 COMERIO
23 COROZAL
24 CULEBRA
25 DORADO
26 FAJARDO
27 GUANICA
28 GUAYAMA
29 GUAYANILLA
30 GUAYNABO
31 GURABO
32 HATILLO
33 HORMIGUEROS
34 HUMACAO
35 ISABELA
36 JAYUYA
37 JUANA DIAZ
38 JUNCOS
39 LAJAS
40 LARES
41 LAS MARIAS
42 LAS PIEDRAS
43 LOIZA
44 LUQUILLO
45 MANATI
46 MARICAO
47 MAUNABO
48 MAYAGUEZ
49 MOCA
50 MOROVIS
51 NAGUABO
52 NARANJITO
53 OROCOVIS
54 PATILLAS
55 PEÑUELAS
56 PONCE
57 QUEBRADILLAS
58 RINCON
59 RIO GRANDE
60 SABANA GRANDE
61 SALINAS
62 SAN GERMAN
63 SAN JUAN (Capital)
64 SAN LORENZO
65 SAN SEBASTIAN
66 SANTA ISABEL
67 TOA ALTA
68 TOA BAJA
69 TRUJILLO ALTO
70 UTUADO
71 VEGA ALTA
72 VEGA BAJA
73 VIEQUES
74 VILLALBA
75 YABUCOA
76 YAUCO
Culebras
Vieques
La Mona
3
(.) Each Dot Represents 1,000 persons.

FIGURE 6

Before 1965, two different rates of population growth were experienced. The first period, which covered from 1950 to 1960, was characterized by a very low population growth rate. The value of 0.63% annual increment was registered during that decade. This was mainly due to a high emigration rate for that period. The second period from 1960 to 1965 marked the highest population growth rate in Puerto Rico's history with a 2.5% for 1963 and 2.0% for 1964. The increment was mainly due to a low emigration rate and very low descent in birth rate for that period. In 1965, the emigration rate increased again, a tendency which continued until 1968, as the population growth rate kept decreasing. 1969 marks the year when, due to an increase of immigrants, the population growth rate has increased sharply.

At present, the population distribution in the Island is 52% in the urban areas and the remaining 48% in rural zones. The urban figure shows an increment of 18% since 1960.

Following the above tendency, it is expected that 53% of the population will reside in urban areas for 1970, and for 1980 this value should increase to 62.2%. This marked increasedin urban population (almost two-thirds of the total) would inevitably result in a sharp augmentation of the air pollution problem.

Industry

Until World War II, the Island's economy was primarily agricultural, depending heavily on such crops as sugar cane, tobacco, coffee, and citrous fruits. During the last two decades there has been a dramatic

The system also includes one (1) gas turbine power plant on the West Coast and eight (8) small hydroelectric plants and numerous auxiliary jet engine power plants scattered throughout the Island. This program, together with the industrialization activities, calls for the establishment of a new steam power plant in the southern portion of the Island.

Regional Arrangements

The Department of Health serves the Commonwealth of Puerto Rico including its overseas territories. The Department activities cover both preventive and curative functions. In many cases, the latter is conducted in coordination and collaboration with municipal governments. Air pollution control activities are conducted under the preventive functions of the Department. (See Figure 8)

The Air Pollution Control Program, officially supported by Act 157, has the responsibility to develop and implement a comprehensive control program for the Commonwealth of Puerto Rico; develop air pollution control regulations to be enforced through a permit and registration system; develop and operate a complaint system as part of the enforcement activities; study and evaluate the air pollution potential and maintain surveillance over pollution levels as part of the air pollution emergency plan; prepare and administer Federal project grants; offer technical assistance to other governmental agencies, industry, and persons concerned with air pollution control;

transition toward industrialization instrumented through an organized plan to provide incentives to attract mainland capital investment. The plan was a success and has resulted in the establishment of new factories and other businesses in the Island at an average rate of over one per day for the last two fiscal years.

More than half of the new establishments will be located outside the San Juan Metropolitan Area. Ninety-three percent of the most important projects will be established in municipalities throughout the Island where unemployment has reached critical levels.

The first phase of the industrialization program calls for the establishment of light and moderate factories. Textiles, clothing, food, rum and chemicals are some examples of the first industries assisted or promoted in the Island. The present phase of industrialization is aimed for the installation of heavy industry. These activities have resulted in the establishment of the three refineries, several petrochemicals, foundries, pharmaceuticals, etc...(Table 2).

Table 3 gives an idea of the magnitude of industry development in terms of net income. Figure 7 shows a graphical representation of this, and Figure 8 shows the distribution of manufacturing establishments throughout the Island.

Industrialization requires, among other things, great amounts of electrical power. The Government has developed an intense program of power production and distribution. At present, there are three(3) steam power plants, two on the North Coast and one in the South.

MANUFACTURING ESTABLISHMENTS AND MAJOR INDUSTRY GROUP
IN PUERTO RICO
1969

Major Industry	Health Districts Areas					
	Northeast	North	East	South	West	Total
Food and kindred products	166	57	66	90	96	475
Tobacco manufacturers	9	13	27	6	2	57
Textile mill products	23	15	13	14	13	78
Apparel and related products	182	36	91	53	99	461
Papel and allied products	92	10	15	18	16	151
Printing, publishing & allied industries						
Chemicals and allied products	70	7	6	12	12	107
Products of petroleum & coal	31	-	9	14	6	60
Rubber products						
Leather and leather products	14	17	23	15	12	81
Lumber	128	39	37	51	45	300
Furniture						
Stone, clay and glass products	105	45	40	25	32	247
Fabricated metal products	162	15	39	25	25	266
Machinery	30	6	11	1	9	57
Transportation Equipment						

Table 2

Cont. 2

Major Industry	Health Districts Areas					
	Northeast	North	East	South	West	Total
Electrical machinery, equipment & supplies	58	9	25	5	6	103
Instruments and related products	12	1	9	3	4	29
Hotel (1)	43	2	3	5	6	59
Guest houses (1)	32	1	2	2	2	39
Laundries, laundries services & cleaning & dyeing plants (2)	110	20	25	23	16	194
Hospitals (3)	43	20	25	29	21	138
Quarry (4)	27	6	11	28	10	82
Micellaneous manufacturing Industries	64	5	14	13	20	116
Totals	1,401	324	491	432	452	3,100

Puerto Rico Department of Labor - 1968 Employment Estatistic Bureau

(1) Economic Development Administration, Department of Tourism - Official List of Hotels and Guest Houses- Summer 70

(2) Information obtained from the Emission Inventory taken by the Air Pollution Control Program, Dept. of Health - 1969-70

(3) Puerto Rico Department of Health - Registry of Hospitals and Nursing Homes 1969-70

(4) Puerto Rico Department of Public Works - List of Permits Issued for the Extraction of Material from the Surface of the Earth - Private 1969

Table 2

NET INCOME ORIGINATED BY INDUSTRIES

(in million dollars)

Industrial Group	1966	1967	1968	1969
1. Food and Kindred products	25.0	29.6	35.9	41.8
2. Tobacco Manufacturers	26.0	27.9	32.4	32.3
Tobacco stemming	3.8	3.5	3.5	3.7
Cigars and Cigarettes	22.8	24.4	28.9	28.6
3. Textile Mill products	21.7	23.3	27.5	33.2
4. Apparel and Related products	85.8	103.2	122.9	151.9
5. Lumber and wood products; Furniture and Fixture	8.8	10.0	11.1	13.5
6. Editorials and printings	1.6	2.0	2.8	3.6
7. Chemicals and Allied products	56.0	78.5	87.7	92.8
8. Stone, clay and glass products	22.5	23.5	26.2	27.7
9. Machinery and metal products	85.1	97.3	115.7	137.1
10. Papel products	3.3	3.8	5.0	5.7
11. Steel products	26.9	35.5	44.3	48.9
12. Other Manufacturing industries	53.6	58.5	62.3	80.8
Total	416.4	493.2	573.8	669.4

Table 3

NET INCOME FROM MANUFACTURING ESTABLISHMENTS

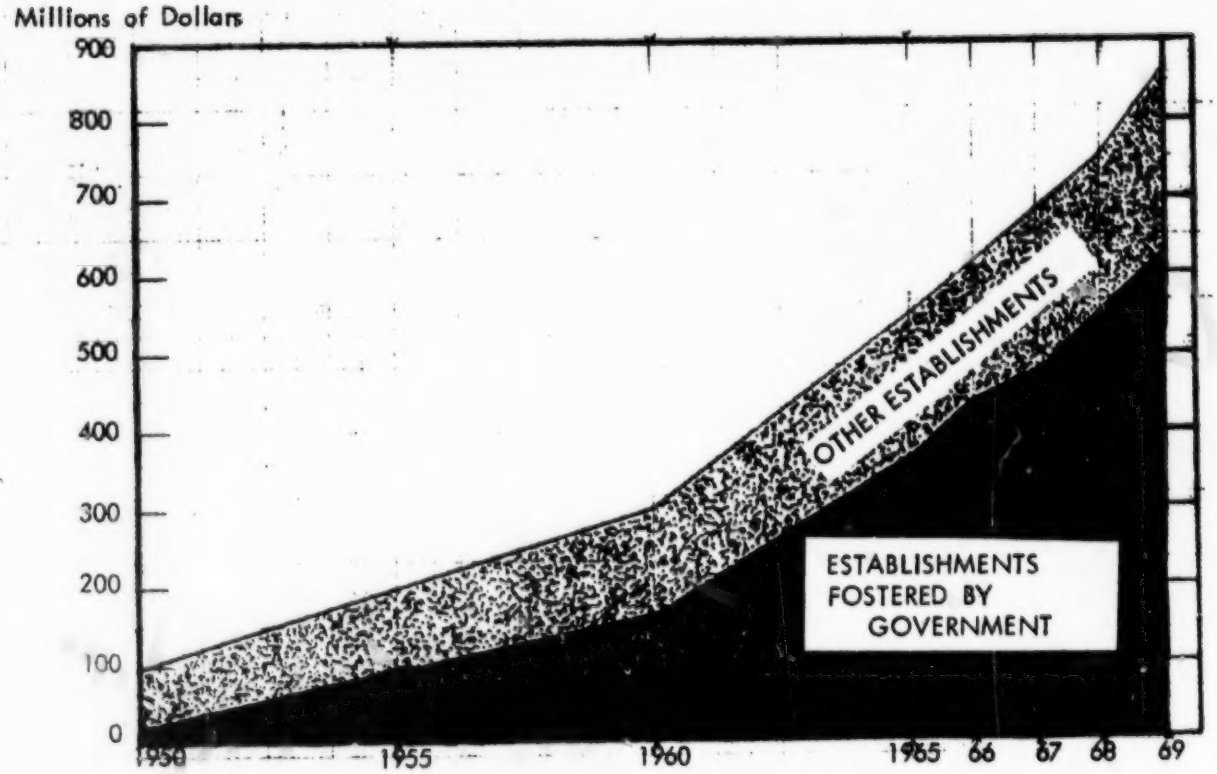

Figure 7

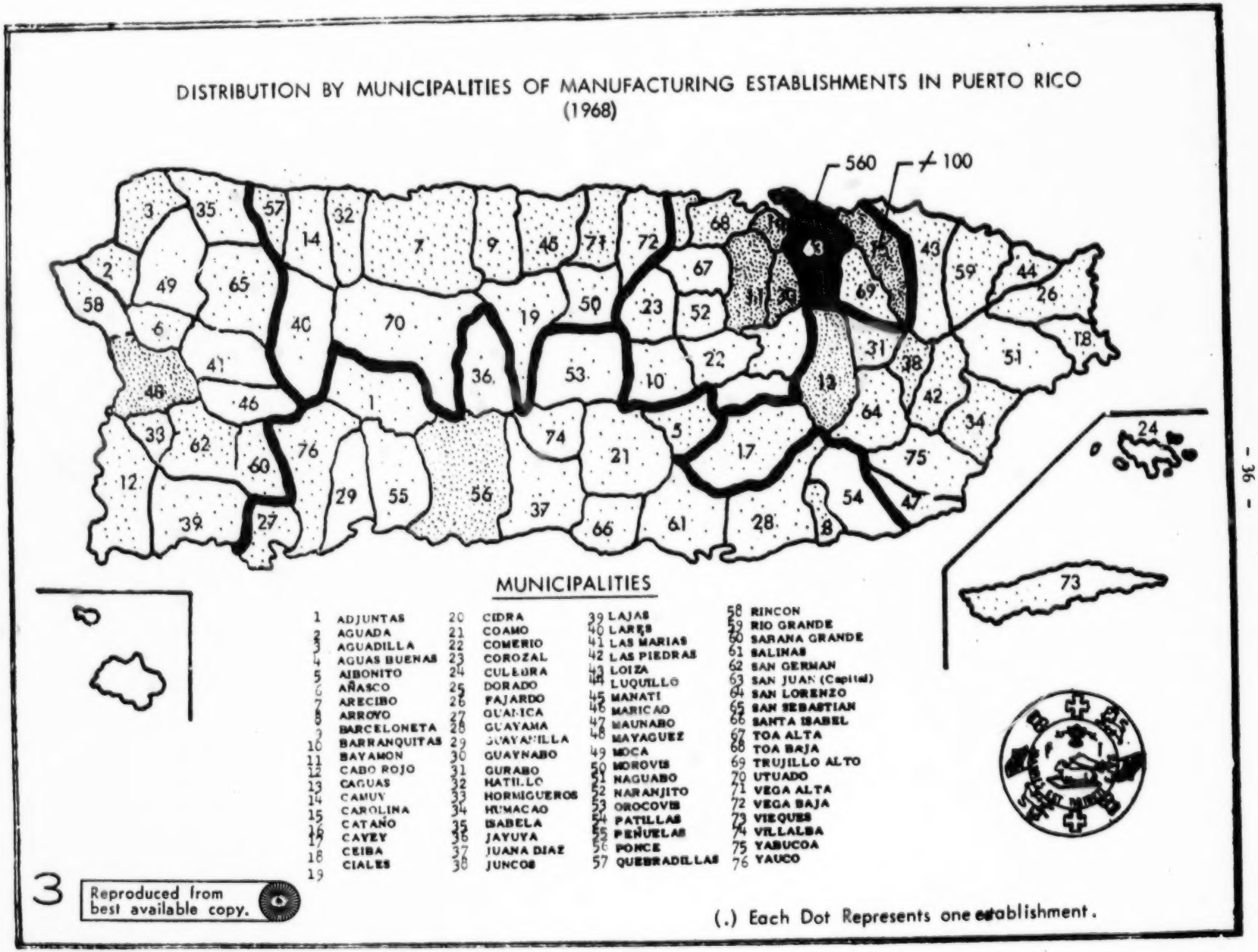

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FIGURE 8

develop and offer training courses; and collaborate with the Air Pollution Advisory Board in their activities.

The program responsibilities are implemented through regional representative offices to expedite and economize the operations on a centralized basis. Air pollution control activities are conducted at local levels in coordination and with the collaboration of the respective Sanitation Office. The annual budget of the program including Federal funds is about $217,000.

Regional Planning

The Planning Board of Puerto Rico is responsible for planning and coordinating the economic, social and physical development in the Commonwealth of Puerto Rico. In the execution of such responsibility the Board serves as an advisory body to the Governor and as a regulatory agency. The regulatory function is centered in the preparation and implementation of a Master Plan for the development of the Island resources. In conjunction with this function, the Board is responsible for developing and implementing rules, regulations and other measures to guarantee benefits from the community from this development. Based on the above objective, the Planning Board and the Department of Health combine their efforts to obtain better living conditions for the community. Regulatory activities are conducted in close coordination through a building permit system where hopefully, most social activity are surveyed and sanctioned.

At present, the Planning Board has the intention to adopt performance standards for urban areas to help in the regulation of land use. Formalizing the zoning ordinances in such standards will translate the classical light, medium and heavy industrial uses into well defined, meaningful terms, dealing with environmental effects. Any performance standards set in the air pollution field by the Planning Board would be in harmony with air quality and emission control standards adopted by the Department of Health, considering the jurisdiction of the latter over air pollution control matters. The performance standards would in this capacity strengthen the control program by providing guidelines to the planning activities and to the building permit system operated by the Planning Board. The Department would absorb most of the technical decisions and all the field work to be conducted as part of its approval system and coordinate the control work to be conducted by the Planning Board through their performance standards.

THE PROPOSED REGION

Subject to the scheduled consultation, the Department of Health of the Commonwealth of Puerto Rico recommends that the Secretary, Department of Health, Education and Welfare designate the Commonwealth of Puerto Rico as an air quality control region consisting of the following jurisdictions of the Commonwealth:

Puerto Rico and surrounding islands

Vieques and surrounding islands

Culebras and surrounding islands

As so proposed, the Commonwealth of Puerto Rico Air Quality Control Region would consist of the territorial area encompassed by the outermost boundaries of the proposed jurisdictions. The proposed Region is shown in Figure 10 . The proposed jurisdictions are shown in Figure 11 - 13.

Discussion of Proposal

To be successful, an air quality control region should meet three basic conditions. First, its boundaries should encompass most pollution sources as well as most people and property affected by those sources. Second, the boundaries should encompass those locations where industrial and residential development will create significant air pollution problems in the future. Third, the boundaries should be chosen in a way which is compatible with and even fosters unified and cooperative governmental administration of the air resources throughout the region.

The proposed region of the Commonwealth of Puerto Rico includes all of the pollution sources and population affected by those sources, and is governed exclusively by the government of the Commonwealth of Puerto Rico. The Commonwealth provides ample area for expansion, both industrial and residential. Moreover, all expansion will

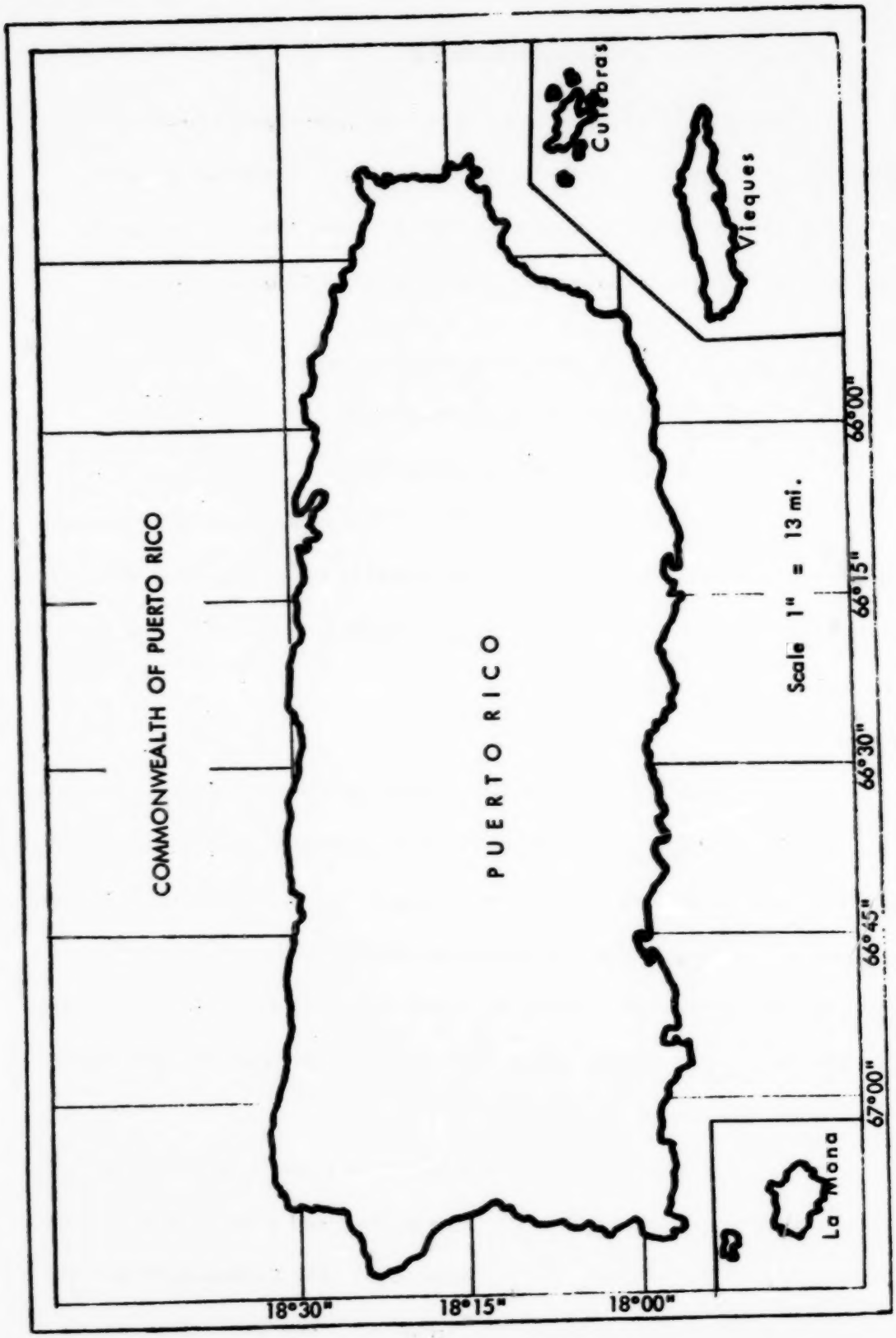
COMMONWEALTH OF PUERTO RICO
PUERTO RICO
Culebras
Vieques
La Mona
Scale 1" = 13 mi.
18°30"
18°15"
18°00"
67°00"
66°45"
66°30"
66°15"
66°00"

Figure 10

be within the proposed boundaries of the region.

The "Evaluation of Engineering Factors" discussed to some extent the first of the basic conditions, and the "Evaluation of Urban Factor", the second and third conditions.

Numerous complaints received about air pollution problems and sampling and studies conducted in relation with them tend to demonstrate the existence of several polluted areas within the region. Generally, these areas are confined to the neighborhood of moderate or heavy pollution sources. The severity of the air pollution problem is related to the spread among pollution sources.

At present, no major air pollution condition exists over the region. Climatological and macrometeorological conditions provide rather constant ventilation of the area assuring to some extent the impossibility that air pollution episodes could occur in the region. Nevertheless, micrometeorological conditions within the entire region and the foregoing discussion tends to indicate that steps must be taken now to adopt and enforce air quality and emission standards, and establish an effective control program to confront the rapidly increasing menace of air pollution.

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6- The 1970 World Almanac. Reader's Digest, México